Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

$$S=\frac{V_1^2}{g}[(\phi)-(\theta)],$$

where $\theta=\int\frac{d\theta}{\cos^3\theta}$ and $\phi=\int\frac{d\phi}{\cos^3\phi}$, both integrals having the same lower limits.

To derive the equation of the trajectory *in vacuo*, eliminate $\tan\theta$ from (11) and (12) by division and addition and we have

$$y=x\tan\phi-\frac{\frac{1}{2}gx^2}{V_1^2},$$

the equation of a parabola whose axis is vertical.

To determine the range, we merely substitute X for x and $-\phi$ for θ in (11); whence $X=\frac{2V_1^2\tan\phi}{g}$. Then since $V\cos\phi=V_1$, $X=\frac{V^2\sin 2\phi}{g}$.

To determine the time of flight, set $\theta=-\phi$ in (10). We have

$$T=\frac{2V_1\tan\phi}{g}=\frac{2V\sin\phi}{g}.$$

To determine velocity, since $V\cos\phi=v\cos\theta=V_1$, we have from (12),

$$v^2\sin^2\theta=V^2\sin^2\phi-2gy.$$

Adding $v^2\cos^2\theta$ to the first member and $V^2\cos^2\phi$ (its equal) to the second member, we get $v^2=V^2-2gy$. In a similar manner, we can determine all the properties of a trajectory *in vacuo*.

A PEDAGOGICAL QUESTION IN SPHERICAL TRIGONOMETRY.

By G. W. GREENWOOD, Professor of Mathematics and Astronomy in McKendree College.

The numerous and seemingly disconnected formulae of right and quadrantal spherical triangles are often found, both by student and instructors, difficult to remember and thus detract from the study of spherical trigonometry.

I have found the application of the general formulae for oblique triangles to these triangles very easy and useful, the necessary sets of formulae being

$$\cos a=\cos b\cos c+\sin b\sin c\cos A\ldots\ldots(1),$$

$$-\cos A=\cos B\cos C-\sin B\sin C\cos a\ldots\ldots(2),$$

$$\cot a\sin b=\cos b\cos C+\sin C\cot A\ldots\ldots(3),$$

$$\frac{\sin a}{\sin A}=\frac{\sin b}{\sin B}=\frac{\sin c}{\sin C}\ldots\ldots(4).$$

The second set can, of course, be written down from the first set by writing $\pi-A$ for a, etc., so that we need remember only the sets (1), (3), and (4). To determine what formula to use in any case, we notice that set (1) connects *three sides and an angle;* set (2), *three angles and a side;* set (3), *two angles and two sides, one of each being included;* set (4), *two angles and two opposite sides.*

We, therefore, choose at once the formula connecting the three given and the one required quantity. In the case of right, or of quadrantal, triangles, one term will always vanish, thus giving the required formula in logarithmic form.

These formulae must sooner or later be learned by the student of spherical trigonometry, and to apply the correct one in any case is easy.

But as an aid in remembering them, we may note that (1) and (3) begin with a *side* and end with the *opposite angle*, the converse being the case in (2). Also in (3) the sides and angles occur in the easily remembered form

$$a,\ b,\ b,\ C,\ C,\ A;$$

and the respective functions occur in the symmetric form

$$\cot,\ \sin,\ \cos,\ \cos,\ \sin,\ \cot.$$

This form of writing (3) I received from the astronomical lectures of Prof. H. H. Turner, of Oxford, and I have found it a very useful way of remembering it.

I think the deduction of the right and quadrantal triangle formulae from these general formulae is economical, and have found it easier to apply them to right triangles than to use the regular formulae by the means of Napier's rules.

They also apply equally well to the quadrantal triangles which are of such frequent occurence in the usual application of spherical trigonometry to elementary astronomy.

◆

DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ARITHMETIC.

166. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

If I sell one of my farms for $\$A,=\$4500$, and the other for $\$B,=\$1800$, I will gain $p\%$, $=5\%$, on cost of both; but if I sell the dearer farm for $\$C,=\$4000$, and the other at cost, I will lose $p\%,=5\%$. Find the cost of each farm.